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Control of the Export of Technology

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INTRODUCTION

It is a clearly established policy of the United States to control the export of arms and technology of military significance. The federal government currently implements the policy through three methods.

First, the export of arms, and technical data relating to arms, is regulated by the Office of Munitions Control (OMC), a branch of the Department of State.[1] The OMC regulates, through a licensing process,[2] various arms and technical data set forth on the United States Munitions List maintained by the State Department.[3] The agency exercises broad discretion in the granting or denial of a license based on national security or foreign policy grounds.[4]

Second, the United States Patent and Trademark office regulates patent applications filed on military technology. These patent applications are made available for inspection by the Atomic Energy Commission and the Secretary of Defense, either of whom may direct that the applications and the subject technology be kept secret.[5] In the event that such secrecy is imposed, the patent application may not be filed in a foreign country without authorization from the agency involved.

Lastly, Congress passed the Export Administration Act of 1979 (EAA)[6] which regulates the export of goods and technology which would make a significant contribution to the military capabilities of potential adversaries to the United States.[7] The EAA directs the Secretary of Commerce to compile a list of data and technology that need be subject to export control. This list has become known as the commodity control list (CCL).[8]

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1. 22 U.S.C. § 2778 (1976).
2. 22 U.S.C. § 2778(b) (1976).
3. 22 C.F.R. § 121.01 (1983).
4. 22 C.F.R. § 123.05 (1983).
5. 35 U.S.C. § 181 (1976).
6. Export Administration Act of 1979, 50 U.S.C. §§ 2401-2420 (Supp. III 1979) (prior to 1981 amendment).
7. *Id.* at § 2402(2)(A).
8. *Id.* at § 2403(b).

This Article explores the effectiveness of these export controls. The focus will be on the extent to which they prevent or delay the acquisition of militarily significant data by the Soviet Union.[9] The implications of export controls on foreign policy, such as restrictions on exports to countries supporting international terrorism, are not considered, although some of the analysis may be applicable.[10]

It is the author's position that any attempt to control export of militarily significant technology will likely fail in its objective. A significant number of alternative means are available to our adversaries by which this technology can be obtained.[11] Although preventative measures might give the United States a lead in technological development, this lead is likely to be short and in some cases insignificant.[12]

This Article suggests that the threat of conflict between the superpowers is best reduced by achieving parity of military force. Rather than seeking parity by arms escalation or reduction, potential adversaries should consider open trade of military technology. By so doing, the high cost of defense can be brought under control.

I. LICENSING CONTROLS

The data and technology which appear on the commodity control list promulgated by the Secretary of Commerce are subject to licensing controls that differ from those applied to items on the state department's United States Munitions List. Less stringent regulations are imposed on the export of CCL data and technology. This is due in part to the nature of the Export Administration Act. The EAA seeks to avoid unnecessary export restrictions.[13] For example, export controls are not imposed when data or technology of comparable quality are available without restriction from other nations.[14] The EAA is also cooperative in

9. The controls will be examined in respect to the Soviet Union as it is the most powerful potential adversary of the United States. From the standpoint of the survival of the United States, the controls have less significance as to other potential adversaries, as all of them appear to be much less powerful than the United States and are likely to remain so for at least the short term.

10. 50 U.S.C. § 2405(i) (Supp. III 1979). The extent to which a powerful potential adversary is able to obtain militarily significant technology may be crucial to the survival of the United States and consequently this separate analysis is warranted.

11. A few of these ways are analyzed in this Article.

12. There was virtually no gap between the United States and the Soviet Union in the development of the hydrogen bomb, DICTIONARY OF AMERICAN HISTORY 316 (1976), and the intercontinental ballistic missile, *Id.* at 324 (1976).

13. *Id.* at § 2402(2).

14. 50 U.S.C. § 2403(e) (Supp. III 1979).

nature, establishing a policy of exercising controls in conjunction with the efforts of United States' allies.[15]

The distinction can also be explained by the differences in the technology. The munitions list is more closely related to military use while the CCL contains data and technology which have both military and civilian uses. However, an overlap does exist since both lists regulate the same technology in an inconsistent manner.[16]

A. Commodity Control List

The Export Administration Act empowers the Office of Export Administration (OEA) of the Department of Commerce to implement export controls. The OEA has implemented a licensing scheme[17] thereby rendering the practice of exporting a privilege rather than a right.[18]

The type of license needed to export depends on the data or technology involved. A general license GTDA[19] is required to export generally available technical data or data which is educational or scientific in nature, yet unrelated to industrial design or production.[20] This type of general license can be used to export to any country. A general license GTDR[21] is required for the export of much of the technical data that cannot be exported under a general license GTDA.[22] With this type of general license, data can be freely shipped to most non-communist countries.[23] There are some types of sensitive data which cannot be sent to commu-

15. *Id.* § 2404(c)(3).

16. For example, certain types of radar are included on both lists. 15 C.F.R. § 399.1 (Group 5) (1984); 22 C.F.R. § 121.01 (Category XI) (1983). *See infra* note 54 and accompanying text. *See also, Attempts to Safeguard Technology Draw Fire*, 212 SCI. 523 (May 1, 1981). "Of course, the lead time gained on a development may provide a significant head start in making further advances in that technology. If one country is more technologically advanced than its potential adversary, the cumulative effect of a lead in several developments could be militarily significant."

17. 50 U.S.C. § 2403(a).

18. The EAA expresses the intent of Congress that "export trade by United States citizens be given a high priority . . ." *id.* § 2402(10), but this falls short of recognizing a right to export.

19. 15 C.F.R. § 379.3 (1984).

20. 15 C.F.R. § 379.3b (1984). Educational data refers to instruction in academic institutions. Data contained in a patent application derived from foreign-origin technology can also be exported under this type of license.

21. 15 C.F.R. § 379.4 (1984).

22. *Id.* No technical data may be exported under a General License GTDR to a country in Group Z. *Id.* at § 379.4(a). On the other hand, certain technical data (e.g., connected with the shipment of a commodity to which the data is related) may be exported under the General License GRDR to a country in Group Q, W, Y, and Afghanistan. *See infra* note 24 for listing of countries within groups.

23. 15 C.F.R. § 379.4 (1984).

nist countries[24] without a special validated license issued by the Secretary of Commerce.[25] This data is generally regarded as representing a higher technical advance and having greater military significance than items which may be exported under a general license.

The procedure for obtaining any type of general license is relatively simple. No application need be filed to obtain a general license.[26] A general license is automatically granted by the regulations,[27] subject to the terms and conditions prescribed therein. The ease by which a general license can be obtained distorts the government's position that there exists no "right" to export. Nonetheless, requiring a license to export enables the government to police exporters by the threat of license suspension or revocation for violations of the terms and conditions under which the license was granted.[28]

In contrast, a validated license is only issued upon an export application to the Office of Export Administration.[29] This application is much more likely to be denied if the export destination is a controlled country rather than an uncontrolled country.[30]

In addition to the general license GTDA and GTDR and the validated license, there exists other varieties of general licenses.[31] These licenses may not be used if the exporter knows or has reason to believe that the commodity will be reexported by the pur-

24. 15 C.F.R. Pt. 370, Supp. 1 (1984). The Communist countries are classified as follows: Country Group P - People's Republic of China; Country Group Q - Rumania; Country Group W - Hungary, Poland; Country Group Y - Albania, Bulgaria, Czechoslovakia, Estonia, German Democratic Republic (including East Berlin), Laos, Latvia, Lithuania, Outer Mongolia, Union of Soviet Socialist Republics; Country Group Z - North Korea, Vietnam, Kampuchea, Cuba. The most severe restrictions are placed upon exports to a country in Group Z.

25. 50 U.S.C. § 2403(a) (Supp. III 1979). A validated license is required for certain types of sensitive data and commodities of special military significance for all countries except Canada. 15 C.F.R. §§ 371.2(c), 379.4(c), 379.4(d) (1984). In many cases a validated license is only required for all or some of the controlled countries. *Id.* at § 399.1(c). For example, almost all CCL items may not be shipped without a validated license to a country in Group Z (i.e., North Korea, Vietnam, Cambodia, Cuba). 15 C.F.R. Pt. 370, Supp. 1 (1984). A validated license is required for many items for shipment to countries in Group Y, which includes the U.S.S.R.

26. *Id.* at § 371.1.

27. 50 U.S.C. § 2403(a) (Supp. III 1979).

28. 15 C.F.R. § 388.3 (1984).

29. *Id.* at § 372.1.

30. 15 C.F.R. § 385.2 (1984). The OEA is required to review applications to export to a controlled country on a case-by-case basis. The review considers the military significance of the data and whether the goods or data are for civilian use only in ruling upon the application.

31. *Id.* at § 371.1-122. Most exports of commodities for use or resale in a country are covered by a General License G-DEST. *Id.* at § 371.3. A special general license is provided for in transit shipments through the United States (general license GIT), *Id.* at § 371.4 and personal baggage (general license baggage), *Id.* at § 371.6.

chaser without authorization by the OEA or Export Administration Regulations.[32] Similarly, export even to uncontrolled countries need often be preceded by receipt of written assurance by the importer that neither the data nor the direct product thereof is intended to be shipped to any controlled country to which the data could not be directly shipped.[33]

As with general licenses, reexports are generally prohibited except to countries to which the item could have been directly shipped with the appropriate license.[34] Export of foreign made goods which are direct products of militarily significant data is restricted to uncontrolled countries.[35]

In addition to licensing control, the EAA provides for periodic review of items on the CCL. The purpose of the review is to add new items and eliminate others as warranted by technological advancements and availability. The review is designed to preserve or create an advantage for the United States regarding new technology of military significance. Implicit in the review is the realization that no country can long remain the exclusive possessor of new technology.

B. United States Munitions List

Governmental control over the manufacture or export of articles on the munitions list[36] is more pervasive than the control over items on the CCL. In the first place, anyone engaged in the manufacture or export of articles on the munitions list must register with the Office of Munitions Control.[37] Equipment on the munitions list may not be exported without a license issued by the Office of Munitions Control[38] upon an application.[39] A license is required regardless of the destination to which the equipment is to be exported. Advance approval of the Office of Munitions Control is even required for any detailed proposal or presentation to

32. *Id.* at § 371.(c)(5).

33. *Id.* at § 379.4. In addition, no General License GRDR is granted if the exporter knows or has reason to believe that the direct product or the data is intended to be exported to any such controlled country. Included on the list of data requiring a written assurance is data which relates to aerial and satellite cameras (*i.e.*, spy cameras), navigational systems with application to submarines and graphite compositions which are useful in advanced aircraft construction. A written assurance is also required for certain items on the CCL that can be shipped to uncontrolled countries under a General License GTDR. *Id.* at § 379.4(f)(2).

34. *Id.* at §§ 374.2, 379.8(b).

35. *Id.* at § 379.8(a). For examples of such data, *see supra* note 33.

36. 22 C.F.R. § 121.01 (1983).

37. *Id.* at § 122.01.

38. *Id.* at § 123.01. There are exemptions from the license requirements for arms of little military significance (*e.g.*, obsolete small arms). *Id.* at § 123.30-37.

39. *Id.* at § 123.50.

sell combat equipment in an amount for $7,000,000 or more on the munitions list for use by an foreign armed forces.[40] This control is necessary because of the likelihood that some technical data will be disclosed in any proposal or presentation made.[41]

Licenses for the manufacture abroad of arms on the munitions list, or for furnishing abroad technical assistance concerning such arms is subject to the advance approval of the Office of Munitions Control.[42] As is the case of a combat equipment proposal or presentation, advance approval for a proposal or presentation for a manufacturing license or technical assistance license is required.[43]

A license is also needed for the export of both data or equipment which has been assigned a security classification,[44] as well as unclassified technical data relating to arms on the munitions list or which advances the state-of-the-art in an area of significant military application.[45] Export of data is defined broadly to include not only direct exports, but also disclosure in the United States to foreign nationals or through visits abroad by United States citizens.[46]

The regulations envision a blanket prohibition of the export and reexport of data and items on the munitions list to communist countries. It is the strongly stated policy of the Department of State not to grant licenses to export data and items on the munitions list to communist countries.[47] Diversion or reexport of equipment or data from the country for which a license is approved is generally prohibited.[48]

II. WEAKNESSES IN THE CONTROL SYSTEM

If there is a gap between the United States and the Soviet Union in any area of military technology, it is the author's contention that the gap is likely to be short-lived because of the large number of ways the lagging country can obtain the technology. This contention is probably only applicable where the lagging country has a strong technological infrastructure and ample resources to utilize one of these ways and to exploit the technology

40. *Id.* at § 123.16.
41. *Id.* at § 123.16(b). Advance approval is only required for a proposal or presentation which communicates information in sufficient detail to permit the intended purchaser to purchase the equipment. A proposal which describes performance, price and probable availability for delivery of the equipment requires prior approval.
42. *Id.* at § 124.01.
43. *Id.* at § 124.06.
44. *Id.* at §§ 125.02, 125.05.
45. *Id.* at §§ 125.01, 125.04.
46. *Id.* at § 125.03.
47. *Id.* at § 126.01.
48. *Id.* at §§ 123.10, 124.10.

once obtained. In other words, export controls are likely to be much more effective against weaker potential adversaries than against a country with a comparable technology base and resources. The controls are also likely to be less effective when a country makes a determined effort to obtain the technology, as has been reported to be the case with the Soviet Union.[49] The difficulty of maintaining the secrecy of technology is illustrated with the case of Japan which has a "system" of seeking out foreign innovations.[50] The Japanese entertain the idea that anything developed in the United States will be in Japan six months later.[51] The recent indictment of several employees of Hitachi for allegedly attempting to steal IBM secrets illustrates the magnitude of the problem. While the United States government may not seek to prevent this transfer as to nonmilitary technology, United States firms have apparently not been too successful in protecting their technological developments.

A country's effort to obtain technology is often facilitated by weaknesses in the export controls employed by other countries. In the United States, for example, the license review procedures inevitably leak some critical military technology or data. This may be especially true of the EAA, which imposes a hasty deadline of ninety days for a decision whether to grant or deny a license.[52] The time limit is designed to minimize damage to the export of technology, but there exists the risk of improper, hastily made decisions. Another weakness is the occasional difficulty in recognizing the military significance of technology which lends itself to civilian use.[53]

Another defect in export controls is the existence of two separate lists administered by two different agencies. The result is that a certain degree of overlap exists between the lists, causing the application of differing policies to the same technology.[54] The ultimate objective of restricting export of military technology to the communist bloc nations would be better served by a single agency having sole jurisdiction.

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49. *Attempts to Safeguard Technology Draw Fire*, 212 SCI. 523, 524 (May 1, 1981).

50. D. SPENCER, TECHNOLOGY GAP IN PERSPECTIVE 31 (1970) [hereinafter cited as D. SPENCER].

51. *Id.* at 34.

52. 50 U.S.C. § 2409(e)-(f) (Supp. III 1979). The Secretary of Defense has the authority to establish categories of transactions which must be submitted to him for review. The Secretary of Defense makes a recommendation to the President, who is limited to a period of thirty days from the date of such recommendation in which to disapprove it. *Id.* at § 2409(g).

53. It should be recognized that the granting of a license does not automatically mean that the technology will fall into Soviet hands, but it does provide another source at which their penetration effort can be directed.

54. *See supra* note 16.

Because of the weaknesses in our own export controls, the Soviet Union has enjoyed some success in obtaining American military technology.[55] The Soviets employ conventional espionage techniques as well as orbital satellites and other sophisticated electronic surveillance to circumvent the United States' efforts to conceal valuable information. The costs of obtaining technology by these methods are probably less than the costs of independent development.

A. Classifying Critical Technology

A potential adversary might possibly obtain new technology of military significance without any dramatic spying effort due to a failure to place the technology or goods on the munitions list or CCL or in granting an export license when it should not have been granted. Neither the munitions list nor the CCL seems to incorporate the important principle of technology control, that it is more important to control a revolutionary development than an evolutionary development. It is easier to control the revolutionary development because the number of practitioners is usually small.[56]

It is probably accurate to assume that the possibility of a breach of security is directly related to the number of people with knowledge of the technology. It is more important to control a revolutionary development because it is more likely to convey a greater lead time, as such developments are difficult to make. If the United States has made an evolutionary development as shown in Figure 1 by advancing from *A* to *B*, little lead time is lost in transferring the technology. However, a significant lead time may be lost in transferring a revolutionary development permitting the transferee to quickly advance from *B* to *C*. Consequently, the central focus, if not the entire concern, of export controls should be on revolutionary developments. The length and diversity of the munitions list and CCL indicates that this is not the case.

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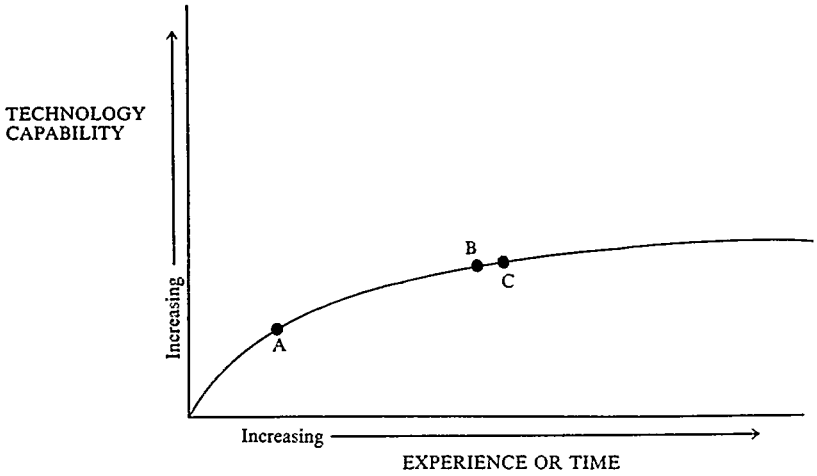
55. *How Russia Steals U.S. Defense Secrets*, U.S. NEWS & WORLD REPORT 39 (May 25, 1981); *How Russia Snares High-Technology Secrets*, BUS. WK. 128 (April 27, 1981). *U.S. Tries to Cut Trade In Items That Russians Might Use for Military*, Wall Street Journal, Feb. 11, 1982, at 1.

56. A revolutionary development is one that represents a technological breakthrough as compared to an evolutionary development which represents the advancement of a more gradually developing line of technology.

57. *Export Licensing of Advanced Technology: A Review. Hearings Before Subcomm. on Int'l Trade and Commerce of the House Comm. on Int'l Relations*, 94th Cong., 1st Sess. 214 (1976) (statement of J. Fred Bucy) [hereinafter cited as 1976 Hearings].

FIGURE 1[57]



Some of the revolutionary advances are made by researchers in universities, who often resist the imposition of government control because they believe it stifles research.[58] The Department of State controls the export of technology on the munitions list by requiring a license for technology "disclosed through visits abroad by American citizens (including participation in briefings and symposia), and disclosed to foreign nationals in the United States (including plant visits and participation in briefings and symposia)."[59] These controls over high technology have been attacked by some universities on grounds of vagueness.[60] Ironically, the controls on high technology are probably the most necessary to preserve a technological lead time.

The Export Administration Act focuses on the critical technologies by indexing.[61] The Office of Export Administration may "prescribe annual increases in the performance levels of goods or technology."[62] Any goods or technology which do not meet the performance levels are to be removed from the CCL unless another agency objects. While indexing does tend to direct the focus of controls towards the more critical technologies, it is primarily designed to facilitate trade. The export regulations do not mention indexing, but do state that it is the policy of the OEA to continuously review the CCL.[63] Perhaps the indexing is done informally in such review. It probably would not be helpful to

58. *Attempts to Safeguard Technology Draw Fire*, 212 SCI. 523 (May 1, 1981).
59. 22 C.F.R. § 125.03 (1983).
60. *Attempts to Safeguard Technology Draw Fire*, 212 SCI. 523 (May 1, 1981).
61. 50 U.S.C. § 2404(g) (Supp. III 1979).
62. *Id.*
63. 15 C.F.R. § 370.1(b) (1984).

quantify the performance levels for most technologies that would justify removal from the CCL. The removal decision is likely to be a subjective decision based upon consideration of a number of factors.

There are certain types of advanced equipment that are the keystone for the manufacture of certain products. For example, titanium forging equipment is the keystone to jet engine manufacture.[64] Without this equipment the manufacture of high performance jet engines is impossible. Consequently, it is far more important to control the export of keystone equipment and technical advances concerning it than other types of equipment. Keystone equipment is listed on the CCL without any special delineation. Presumably, the OEA discriminates between keystone equipment and other types of equipment in the licensing process, but the chances of inadvertently licensing the export of a piece of keystone equipment or technology is increased by having too many items on the CCL.

A problem inherent to the classification of controlled technology is the determination as to which technology would be of military significance to our adversaries. One can envision how a technology of little military value to the United States could unforseeably be significantly more valuable to an adversary. Conversely, much of the concern over the export of large computers to the Soviet Union is considered by some commentators to be unfounded.[65] Once resolved, the task becomes on which of the export control lists the technology should be placed. Technology must be "militarily critical" to be placed on the CCL,[66] but it is only necessary that an item be armament technology to be placed on the munitions list.[67]

It would seem to be an inherent characteristic of the munitions list that all of the technology and goods would be militarily critical. However, that is not the case as the munitions list contains many conventional arms because exports are controlled for both national security and foreign policy reasons.[68]

The failure to include militarily significant goods or technology on the munitions list or the CCL does not mean that the Soviet Union has access unless it is directly exported to them. However, the transfer of the goods or technology to another country increases their chances of access to some degree.

64. 1976 Hearings, *supra* note 57.
65. H. R. NAU, TECHNOLOGY TRANSFER AND U.S. FOREIGN POLICY 24 (1976).
66. 50 U.S.C. § 2404(d) (Supp. III 1979).
67. 22 C.F.R. § 121.01 (1983).
68. For example, nonautomatic firearms and bayonets are included on the munitions list. 22 C.F.R. § 121.01 (1983).

One of the most serious weaknesses in the export control system appears to be in failing to adequately indentify and focus attention on revolutionary advances, keystone equipment and technology which are in fact militarily critical. This failure results in the control effect becoming dissipated.

B. Information Available in the United States

Presumably any potential adversary would have access to data that was generally available to the public in this country. The fact that data is publicly available does not mean that it can be obtained cost-free. Because of the plethora of sources and quantity of public data, the search and analysis costs might be significant. A thorough search would include an analysis of scientific and educational data which does not have any direct military application, as it might provide a base for the development of a military application.

Despite the secrecy surrounding scientific development of new technology in the United States, the Soviet Union enjoys free access to a multitude of technological literature. This is especially true of literature concerning technology having both civilian and military capabilities. This information may enable the Soviet Union to surmise the direction of American technological development. For example, the publicity surrounding the development of the stealth bomber by the United States,[69] and the role of graphite compositions in that development, likely encouraged the Soviets to develop similar aircraft.

As in the case of dissemination of scientific knowledge, the training of foreign students in universities in the United States facilitates the dissemination of technology. A hint about technical development can often be obtained at trade shows in the West, which the Soviets regularly attend. The hiring of personnel skilled in the technology is sometimes successful.[70]

It appears to be a major weakness of the export controls that they do not bar disclosure of technology on the CCL within the United States except with knowledge or intent that the data will be exported.[71] The EAA does not otherwise impose any secrecy obligation upon firms or individuals that possess technical data on the CCL. The underlying assumption of the EAA must be that it

69. *No Stealth or Shame*, Wall Street Journal, Sept. 9, 1980, at 32, col. 1.
70. 1976 Hearings, *supra* note 57, at 122 (statement of Thomas A. Christiansen).
71. 15 C.F.R. § 379.1(b) (1984). Export of technical data is defined as the export out of the United States or "any release of technical data in the United States with knowledge or intent that" it will be exported. A general or validated license is needed to export technical data.

would not be in the best interest for a firm to publicly disclose the valuable proprietary information. While control over internal dissemination would increase the effectiveness of the system, it would do so at a cost to domestic commerce and technical progress.

While the controls over items on the munitions list are more pervasive than the controls over the CCL, there are also some apparent gaps in the controls over the former. Unless data or equipment on the munitions list has a security classification, there is no ban against public or private disclosure in the United States unless it could be asserted that this constituted an "export."[72] Private disclosure to the wrong party could result in an unauthorized export. Self-interest of the owners of proprietary information undoubtedly minimizes such disclosures.

Export control could be facilitated through the registration of arms manufacturers.[73] The licensing of manufacturers would perhaps reduce the risk of untrustworthy persons exporting sensitive data and equipment. Currently, registration of the manufacturers of items on the CCL is not required. This again exemplifies the inconsistencies between controls exercised over the CCL and the munitions list which is not justifiable on the mere ground of encouraging trade of civilian trade.

Another readily apparent gap in export controls is the failure to control internal disclosure. This gap is partly closed by the fact that some of the more militarily critical information was developed for the military and bears a security classification. Greater control over internal dissemination was not granted because it is incompatible with our open society and the need for scientific data to be freely disseminated to aid in scientific progress.

C. Information Available Abroad

In spite of the prohibition on reexport of technical data and the export of goods made from such data to any controlled country, it is difficult for the United States to control activities abroad. While these bans purport to apply to any "person in a foreign country,"[74] many of these people are beyond the jurisdiction of federal courts. Future shipments to a straying importer can be prohibited,[75] but the threat of this sanction may be insufficient to

72. 22 C.F.R. § 125.03 (1983). Perhaps under certain circumstances it could be argued that public disclosure inevitably involved disclosure to foreign nationals and, hence, constituted an export. However, this argument seems tenuous.

73. *Id.* at § 122.01.

74. 15 C.F.R. §§ 374.1, 379.8 (1984).

75. *Id.* at § 387.1(b).

deter violations even though violations of the EAA or other regulations are subject to severe criminal sanctions.[76] In addition to the inability of the United States to control activities abroad, the presence of the goods or technology abroad provides another target for the intelligence gathering operation of a potential adversary.

As the export control mechanism is based largely upon restricting exports to controlled countries, the President can add or drop a country from the controlled group at any time.[77] However, if critical data or goods have been shipped to a friendly country which later becomes allied with a country in the controlled group, the effectiveness of the export controls is diminished. The recent revolution in Iran serves as a vivid example of how quickly a country can become unfriendly to the United States and exposes the vulnerability of export controls that permit shipments to "unstable" countries.

The EAA dictates that export controls not be imposed upon goods or technology which "are available without restriction from sources outside the United States in significant quantities and comparable in quality to those produced in the United States."[78] Congress recognized that imposing controls when the goods or technology were available abroad was not only a futile gesture but adversely affected the balance of payments and domestic employment.[79] The OEA is required to review on a continuing basis the availability of goods and technology from sources outside of the United States.[80]

In order to maintain some degree of uniformity in export controls between the United States and its allies, an informal organization called COCOM has been formed.[81] Members of COCOM consist of the United States, Japan, and all members of the North Atlantic Treaty Organization, except for Iceland. COCOM is essentially a type of cartel which uses the boycott tactic to keep militarily critical technology from the Soviet Union and its allies. A boycott will obviously not be successful unless all of the countries which possess the technology join the cartel. Two important industrial nations, Sweden and Switzerland, are not members of COCOM. Consequently, the Soviet Union can sometimes obtain

76. 50 U.S.C. 2410 (Supp. III 1979).
77. 50 U.S.C. § 2404(b) (Supp. III 1979).
78. 50 U.S.C. § 2403(c) (Supp. III 1979).
79. *Id.* at § 2401(2).
80. *Id.* at § 2404(f).
81. 1976 Hearings, *supra* note 57, at 8 (statement of J. Kenneth Fasick). The EAA requires the United States to enter into negotiations for multilateral export controls. 50 U.S.C. 2404(i) (Supp. III 1979).

the technology from a non-COCOM country.[82] Since most of western technology originates in COCOM countries, the Soviet Union will sometimes be unsuccessful. If the technology is available in a single non-COCOM country, the Soviet Union may have to pay a monopoly price for the technology. If this should occur, the boycott would be partially successful because the high price would mean that the Soviet Union would have to forego some other purchase.

The main obstacle to the success of the boycott is "in the incentive to cheat that is dangled before the members."[83] Honesty is a foolish policy for each member of COCOM if the other countries cannot be counted upon to comply with the boycott.[84] A single member of COCOM may be able to sell goods or technology to the Soviet Union at a monopoly price if the goods or technology are not available elsewhere. While the sale would not directly help the cheating country if it were made by a private company, the money would aid the domestic economy. The fear that other members of COCOM are cheating may lead an otherwise honest member to cheat. On the other hand, national security and foreign policy considerations may tend to curb the cheating tendency. One would think that extensive cheating would be detected but sporadic cheating may not be. A country may be able to use the excuse of inadvertence for some cheating.

The implication of applying the cartel theory to this situation is that the less temptation that COCOM places in the way of its members, the greater cooperation that is likely to occur. Consequently, only technology and goods that are militarily critical should be subject to control. Perhaps control should be limited to the revolutionary developments. This should result in greater cooperation being obtained in recognition of the mutual necessity. Also, cheating may be easier to detect because independent development in the Soviet Union can often be discounted. Cheating would also be easier to detect when dealing with revolutionary technology as fewer members of COCOM would probably have access to it. The author was unable to find many verified incidents of cheating, but success is not likely to be publicized by the cheating party. Members of COCOM are likely to maintain an outward appearance of cooperation.

With the growing technological base of many foreign countries,

82. 1976 Hearings, *supra* note 57, at 19 (statement of Graham T. Allison). Sweden contracted to develop a computerized air traffic control system after IBM's license application was denied.

83. D. DEWEY, MONOPOLY AND ECONOMICS IN LAW 18 (1959).

84. 1976 Hearings, *supra* note 57, at 56-57, 178-80 (discussion of the possibility of cheating in COCOM).

export controls are not likely to be very effective without greater and more universal multilateral cooperation. The tendency of countries to cheat would probably be minimized by concentrating on truly revolutionary technology of military significance as a nation's self survival is more clearly threatened by the export of such technology. This approach is also called for by purely domestic considerations.

If the export control system is to be effective, a number of large gaps will have to be closed. The control effort should concentrate on the revolutionary technology of military significance rather than insignificant items. It is imperative that greater multilateral cooperation be obtained. This approach requires a lengthier review process, which is warranted by the high level of technology being reviewed. Yet, even if these steps were taken, there is no assurance that the control system will even be moderately effective since there will always be a large number of methods by which a resourceful adversary can obtain technology. It does not appear to be feasible to significantly reduce internal disclosure without unduly impeding technical progress and endangering the openness of our society.

D. Independent Development

The export controls of the EAA apply to technology and goods but not to scientific knowledge. The definition of technology is limited by the EAA to "information and know-how that can be used to design, produce . . . goods."[85] Scientific knowledge refers to "knowledge of the physical world and its phenomena."[86] Scientific knowledge is also not included on the munitions list.[87] While scientific knowledge is not subsumed in the EAA definition of technology because it cannot be used to design or produce goods,[88] it remains the base upon which technology is developed.

The absence of export controls on scientific knowledge and the universal proclivity of scientists to publicize the results of their research has led to wide dissemination of new scientific knowledge. The proliferation of scientific journals and seminars has provided numerous public forums for the presentation of the smallest advances in knowledge. In addition, the best technical

85. 50 U.S.C. § 2415(4) (Supp. III 1979).
86. 1976 Hearings, *supra* note 57, at 213 (1976) (statement of J. Fred Bucy).
87. Technical data relating to articles on the munitions list is included on the list. 22 C.F.R. § 121.01 (Category XVIII) (1984). Technical data is defined to mean information that can be used in the manufacture of items on the munitions list. *Id.* at § 125.01. As scientific knowledge cannot normally be so used, it would seem to be excluded by implication.
88. 50 U.S.C. § 2415(4) (Supp. III 1979).

universities (especially in the United States) frequently admit foreign students[89] who are exposed to the latest scientific advances, which they take back to their home countries. There are many visits and exchanges between scientists of different countries for the purpose of exchanging discoveries and ideas, etc.

While scientific knowledge has no immediate military application, it is often the basis of new military technology.[90] Due to the wide dissemination of information, the United States and the Soviet Union frequently commence development with essentially the same scientific base. It is also important to bear in mind that advances are increasingly being made abroad by our allies and potential adversaries alike. The Soviets have become very proficient in making advances in certain fields of scientific knowledge.[91] The increased success in science by a potential adversary strengthens its technological infrastructure, by facilitating the development of new military technology.

Thus, it is not surprising that the United States and the Soviet Union frequently develop similar technology at about the same point in time.[92] This same phenomenon frequently occurs in the development of civilian technology where two or more firms contemporaneously develop the same new technology.[93] In fact, patent interference proceedings are frequently necessary to determine who developed an important technology first.[94] The contemporaneous development of civilian and military technology is seldom, if ever, merely a random event. Rather, it is due to the scientific base reaching the level necessary for development.

Export controls are not applied to scientific knowledge largely because it does not have any immediate military application. Implicit in the lack of control over scientific knowledge is the recognition that early dissemination of knowledge is essential for

89. There are approximately 235,000 foreign students studying in colleges and universities in the United States in 1978. MARQUIS, ACADEMIC MEDIA OF YEARBOOK OF HIGHER EDUCATION 645 (12th ed. 1980-81).

90. For example, microprocessors were rapidly adapted to military use.

91. *Transfer of Technology to the Soviet Union and Eastern Europe: Hearings Before the Permanent Subcomm. on Investigations of the Senate Comm. on Governmental Affairs* 95th Cong., 1st Sess. 3 (1977) (statement of J. Fred Bucy).

92. *See supra* note 12 for examples.

93. For example, the antibiotic, tetracycline, was discovered at about the same time by researchers at American Cyanamid Co., Bristol Laboratories, Inc., Heyden Chemical Corporation and Chas. Pfizer & Co., FEDERAL TRADE COMMISSION, ECONOMICS REPORT ON ANTIBIOTICS MANUFACTURE 232 (1958). *See* BOTTCHER, WONDER DRUGS—A HISTORY OF ANTIBIOTICS 188-90 (1964).

94. 35 U.S.C. § 102(g) (1976). Under the United States patent system, a patent is awarded to the first inventor. An interference procedure has been established to determine priority between two or more persons who claim the same patentable invention. 37 C.F.R. §§ 1.201-1.286 (1983). *See* Marquis, *A Multiple Patent Proposal*, 14 IDEA 145 (1970).

scientific progress, a goal that Congress obviously thought outweighed any military advantage that might be lost by early dissemination of scientific knowledge. The absence of controls creates an inherent weakness in the system. However, an attempt to impose any greater governmental controls on the dissemination of scientific knowledge would undoubtedly result in an uproar in the scientific community. It might be difficult to effectively administer such controls without severely restricting the freedom of inquiry enjoyed by researchers.

Nevertheless, the early and wide dissemination of new scientific knowledge may tend to result in the two potential adversaries contemporaneously developing military applications based upon the scientific knowledge. Of course, in some cases the military technology is based upon relatively old scientific knowledge. Because of the wide dissemination of scientific knowledge and the controls on technology export, any gap between the two potential adversaries is likely to be in technology and not in scientific knowledge.[95]

III. RESOURCE FREEING THEORY

Diametrically opposed to the concept of controlling only the export of militarily critical technology is the resource-freeing theory.[96] Under this theory any technology transferred to a potential adversary frees some of its technological resources from the consumer sector for use in the military sector. For example, the sale of wheat to the Soviet Union arguably frees some of their agricultural resources and personnel for utilization in other areas so that the freed resources can be filtered through to enhance their military capability. Taken to its logical conclusion, all trade with a potential adversary would be stopped. Adoption of this theory would not be very compatible with the pursuit of detente. The United States would also forfeit the advantages it has been receiving from such trade, for example, disposing of surplus agricultural crops for money needed to buy imported oil. It would also seem that the further removed the traded goods are from the military field, the greater the inefficiency in ultimately freeing resources for use in enhancing military capability. This approach would also undoubtedly force the Soviet Union to become more self-sufficient in all areas. The decreased interdependence on the United States might be destabilizing and lead to reckless political or military action. The resource-freeing theory does not have much to commend it for adoption by the United States at the present time.

95. D. SPENCER, *supra* note 50, at 17.
96. Note, *U.S. Technology Transfers to Soviet Union and the Protection of National Security*, LAW & POL'Y. INT'L BUS. 1137, 1156 (1979).

It does not seem to be applied in war time, but even then there may be mutual advantages for trading with the enemy.[97]

IV. ADVANTAGES OF TRADE

The underlying assumption made by the United States in restricting the flow of militarily significant goods and technology to the Soviet Union is that the United States cannot benefit from trade that involves such exports. This assumption is contrary to the well accepted conclusion that trade in goods between two countries is to their mutual advantage if certain conditions are met.[98] These conditions are:

> (1) Each country differs from the other in the marginal valuation of two or more goods;
> (2) Each country exports goods it values less than the goods it acquires;
> (3) The terms of trade lie within the limits of the respective marginal valuations of the two countries.[99]

In other words, each country sacrifices the item exported, but each places a higher value on the imported item.

It is commonly thought that the above analysis does not apply to trade in militarily significant goods (hereinafter called "military arms")[100] because of national security considerations. It is more accurate to state that the above analysis is equally applicable to military arms, but that unlike most other goods, a national value is placed upon denying military arms to a potential adversary for national security reasons. Arms exported to a potential adversary may significantly enhance its military capability. No country relishes the thought that exported arms might be used against it in an armed conflict. There is a danger that too much emphasis may be placed on this point when comparable arms are available from other sources. Trade in military arms is also different from other goods in that a high national value is often placed upon making military arms available to allies for mutual defense or offense. The values of denying arms to potential adversaries and making arms available to allies results in the commonly observed phenomenon of greater arms trade among allies than potential adversaries even when armed conflict is not imminent. Acceptance of

97. *See* J. HELLER, CATCH 22 411 (1961).
98. A. ALCHIAN & W. ALLEN, UNIVERSITY ECONOMICS 723 (3d ed. 1972) [hereinafter cited as UNIVERSITY ECONOMICS].
99. *Id.*
100. While military arms are only one class of militarily significant goods, it is believed that the trade analysis is applicable to all classes of militarily significant goods. Some goods, such as computer technology, may enhance military capacity more than certain types of arms.

these values by the United States translates in economic terms to money lost by foregoing arms sales to potential adversaries and lowering arms prices to induce allies to buy arms rather than non-military goods. These lost dollars mean fewer imported goods for the United States.

The analysis of arms trade has so far proceeded on the assumption that only private goods are traded. Private goods are those whose utility to a person is dependent upon the quantity he has and "the more he has of that good, the less someone else must have."[101] A military tank is a private good in that a tank being used by the United States Army cannot be used at the same time by the Soviet Army. Technology is not a private good in that the amount used by one person does not reduce the amount that can be used by someone else.[102] Economists call such goods "public goods."[103] Not only is technology a public good, but arms incorporating technology that can be learned from inspection also have attributes of public goods.

The above analysis of trade in private goods must be modified in several respects when applied to trade in arms technology, a public good. It would seem that arms technology could be used simultaneously by all countries without diminishing its use by the originating country or any other country. Consequently, the originating country need not give up use of the technology exported. If all of the costs for producing the technology are allocated to arms produced in the originating country, there are obviously no production costs on exported technology. Unlike private goods, the costs of export, e.g., transportation,[104] are minimal for technology.

An added advantage of exporting technology is that the anticipated profits provide an additional incentive to produce technology.[105] This benefits the exporting country as it has more technology to trade. Less is lost by exporting technology if new technology is constantly being developed, as delays in transfer preserve a continuous lead time for the exporting country. It is frequently assumed that it is impossible to produce too much technology, but fewer goods and services are produced at the expense of expanded technology production. This must be balanced against the extent to which the technology reduces the cost of producing goods and services. We assume, without really knowing,

101. UNIVERSITY ECONOMICS, *supra* note 98, at 147.
102. L. YEAGER & D. TUERCK, FOREIGN TRADE & U.S. POLICY 15 (1976).
103. UNIVERSITY ECONOMICS, *supra* note 98, at 147.
104. C. KINDLEBERGER, FOREIGN TRADE AND THE NATIONAL ECONOMY 9 (1962).
105. UNIVERSITY ECONOMICS, *supra* note 98, at 246.

that the cost of the technology production is usually less than the cost reduction in goods and services production to which the technology relates.

While these considerations largely weigh in favor of a country freely trading its arms technology, there are several other trade considerations that must be taken into account. Export of technology is similar to export of capital goods in one respect; both may be used to produce goods for domestic use or export which may adversely affect exports of such goods from the country in which the technology or capital goods originated. This will only occur where the country importing the technology or capital goods has a comparative cost advantage over the originating country in producing and transporting the goods. The originating country can price the technology to remove the anticipated comparative cost advantage on exports that would otherwise be enjoyed by the importing country.

The technology exported may lead to the development of additional technology in the importing country which may give it a trade advantage, especially if the additional technology is not developed in the exporting country. The fear of this happening may be a significant factor deterring technology exports.

In spite of these negative factors, it is contended that the pro trade factors dictate that trade in arms technology should not be arbitrarily foreclosed. Proper analysis requires balancing the national gains and losses from transferring technology against the value of what is recieved in return. This approach would not inevitably lead to increased exports of arms technology, but it is contended that the analysis provides a better framework for decisionmaking. This approach also takes into account that arms technology is a public good and the ramifications of exporting this type of public good.

The transaction costs of exporting arms technology under the present procedure appear to be significant. The complexity of the procedure for obtaining an export license necessitates that an arms exporter master expensive expertise to obtain a license. The delays frequently encountered in securing a license add to the transaction costs. The greater the transaction costs, the greater the deviation from the optimum amount of trade. One might think that transaction costs would have little impact on trade since the other costs of exporting technology are minimal. However, the transaction costs reduce the exporter's profits which he must weigh against anticipated losses from diffusion of the technology. Consequently, he will either increase the price of the technology by the amount of the transaction costs or possibly forego the trade,

resulting in less overall trade. While transaction costs could be reduced by simplifying the licensing process and concentrating the regulatory effort on controlling revolutionary technology, these transaction costs cannot be removed without abandoning government regulation.

The major difference between exporting arms technology and other types of public goods is that a national security value must be inserted into the trade equation for arms. Not inserting this value could drastically alter the relative military strength of the two countries. Inserting this value necessarily means that the terms and conditions of the trade must be set or regulated by the government and not be a private party. While a private party conceivably may take the security of his nation into account, his personal loss in security by one sale is infinitesimally less than total loss of all individuals in the nation. The trading individual's loss in security is nearly certain to be overbalanced by his private gain from the trade. This is not to suggest that the trading individual will only evaluate the trade in economic terms. Other values, such as national loyalty, may influence the decision of some individuals. However, the determination of whether arms export is beneficial to the United States should be made by the government who can assess the national security value on behalf of the entire nation.

In advocating government assessment of security value, it is not suggested that the government should force the export of arms owned by a private party when the government concludes that the trade would be beneficial to the United States. It is conceivable that the trade would not be perceived by a private party as being beneficial to him. There does not seem to be any compelling reason to alter the rule applicable to other goods that the owner of the goods must initiate the trade. The government only serves to block a trade which is not in the best interest of the United States for some reason.

In order to have a basis for trade, both countries must be willing. At present, the United States is not willing to trade arms with the Soviet Union. In the 1930's the Soviet Union pursued a goal of self-sufficiency in economic and technical development and was uninterested in trade.[106] The Soviet Union now appears to recognize certain weaknesses in its technology and is more interested in trading with the West.[107]

It might be argued that the Soviet Union would not be inter-

106. G. HOLLIDAY, TECHNOLOGY TRANSFERS TO THE U.S.S.R. 1928-1937 and 1966-1975. The Role of Western Technology in Soviet Economic Development.
107. *Id.*

ested in trading for military arms of the United States if the author's conclusion is correct that the Soviet Union is likely to obtain the technology regardless of the controls. However, the Soviet Union incurs transaction costs, which may be significant, in obtaining the technology. Of course, there is no assurance of success and any delay in obtaining the technology helps maintain a headstart advantage for the United States.

The Soviet Union would not be interested in a trade if they concluded that their transaction costs, plus the anticipated costs of delay, would be less than the cost of the trade (i.e., value of their export traded). Entering into trade negotiations should shed considerable light upon the Soviet Union's perception of its success in quickly obtaining Western technology.

Because the private party may only be willing to sell the arms for money, the government may decide in some cases that the value of injecting the money into the domestic economy is more than offset by the loss in national security. In such cases, it might be desirable for the government to buy the technology from the private party and trade with the Soviet Union for arms or other goods the government deems of greater value to it, which would be licensed or sold to private firms or utilized by the government.

An argument can be made that any trade should be limited to the barter of arms. It may be easier for each country to evaluate the national security ramifications of a barter of arms than a cash sale. A barter between three countries may be feasible in some situations. Suppose that Country *A* has developed a new tank for which Country *B* is willing to trade a certain quantity of wheat. While the wheat has no direct military significance, Country *A* might be able to trade the wheat with Country *C* for arms. The three party trade would be beneficial to Country *A* from a military standpoint if the arms it received from Country *C* were more valuable to it than the arms sold to Country *B*. Indeed, trade should not be arbitrarily limited to barter as Country *B* could pay Country *A* who could then buy the technology from Country *C*.

It can be argued that trade should not be limited to barter, as a value can always be placed upon national security. If the price received is high enough, it may strengthen the overall domestic economy more than enough to compensate for any loss in national security.

At least a balancing of the gain and loss from trade is attempted under this approach. Under the present approach, governmental review is limited to the question of military significance to the Soviet Union without considering any gain to the United States. The gain and loss from trade should be considered from both the

long and short term standpoint. For example, high technology might not have any impact upon short term military significance but may have immense military significance in the future. Conversely, state-of-the-art arms may enhance short term military capability but have little long term significance. Balancing short term and long term gains and losses involves assessing the prospect of conflict at various points of time. Of course, arms have a deterrence value which may be as important as their value in war.

Under the approach suggested, arms export should not be viewed in a strict control sense but rather from a trade standpoint which also considers national security values. Consequently, a central governmental "licensing agency" should be more appropriate than an "export control agency." As in the present situation, mutilateral cooperation is essential to achieving these objectives. Ideally, a multilateral licensing agency could be established to handle the licensing.

CONCLUSION

It seems unlikely that the present export controls are very effective in preventing militarily significant data from being obtained by the Soviet Union. The Soviet Union appears to be very determined and resourceful, and there are many repositories for much of the technical data they desire. Because much of the data is probably obtained surreptitiously, it is difficult to empirically verify their success. There are two ways in which to deal with this problem.

More pervasive controls could be imposed upon export of technology, especially revolutionary technology. It would also be necessary to impose controls on dissemination within the United States. In addition, controls on the domestic dissemination of scientific knowledge would need to be imposed. The imposition of pervasive controls by the United States would not work without multilateral cooperation by all of the non-Communist countries that possess the technology desired by the Soviet Union. While it might be possible to secure the greater cooperation of the allies of the United States, it seems unlikely that the non-aligned countries would cooperate. The most serious objections to imposing more pervasive controls are that it is inconsistent with principles of a democratic society and controlling the dissemination of data impedes scientific research. It would also interfere with the education mission of the science departments of universities.

The author proposes that militarily significant technology should be made available for trade. The emphasis should not be on denying access to the Soviet Union, but rather whether the

United States receives imported goods or technology that it values more than what it exported. It is believed that multilateral cooperation may be easier to achieve with a limited trading mechanism than with the present embargo approach. There might not be much more trading under the proposed approach than under the present system, but it facilitates a more objective evaluation of the costs and gains to the United States of a proposed trade.

It is conceivable that a trading approach would tend to maintain a parity in militarily significant technology between the United States and the Soviet Union. For example, if the Soviet Union were behind in a critical area, they would likely be willing to pay a high price for the technology. While it is common to think that the United States is more secure if it has a superior military advantage, there may in fact be a greater chance of conflict if one adversary has a significant edge.

The degree of effectiveness of the controls may be directly related to the probability of war between the two potential adversaries. If one country is able to make important technological developments and maintain an exclusive position, it may seek to exploit its advantage. Fear that it may do so may provoke preemptive action by the less powerful adversary before it is too late to have a prospect of success. Thus, the export controls may have a destabilizing influence.

From the standpoint of military power, the world appears to be bipolar in that a bloc will fight a major war rather than permitting the rival bloc from obtaining preponderant strength.[108] A bloc that thought the other bloc was in the process of obtaining preponderant strength might be tempted to launch a preemptive strike. It would be less tempting to do so if the deprived bloc could obtain the technology, even at a monopoly price. The fact that we have not had a major war since World War II may be some indication of the stability of a bipolar world. If that is true, steps should be taken to preserve it. It is believed that increased trade in militarily significant data may have a preservation effect.

108. KAPLAN, SYSTEM AND PURPOSE IN INTERNATIONAL POLITICS 36 (1957).